



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/715,227	11/17/2003	Zhiping Yin	3657.SUS (98-0265.05/US)	5021
63162	7590	11/20/2007		
TRASK BRITT, P.C./ MICRON TECHNOLOGY			EXAMINER	
P.O. BOX 2550			LEWIS, MONICA	
SALT LAKE CITY, UT 84110			ART UNIT	PAPER NUMBER
			2822	
			NOTIFICATION DATE	DELIVERY MODE
			11/20/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

USPTOMail@traskbritt.com

26

Office Action Summary	Application No. 10/715,227	Applicant(s) YIN, ZHIPING	
	Examiner Monica Lewis	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 September 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-12 and 14 is/are pending in the application.
 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-12 and 14 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
 a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office action is in response to the amendment filed September 6, 2007.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claim 1 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contain the following subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention: a) substantially free of in-film particles or surface roughness features of **more than** about 150 nm. Applicant discloses in the specification that the layer may be “substantially free of particles or surface roughness features **in the** about 120-150 nm size range” (See Specification Paragraph 37).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 2822

5. Claims 1-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art.

In regards to claim 1, Applicant's Prior Art discloses the following:

a) a first layer (42) comprising anti-reflective material (For Example: See Figure 4);

b) a second layer (46) comprising silicon nitride, located over the first layer, and including in-film particles (44) (For Example: See Figure 4); and

c) substantially free of in-film particles or surface roughness of more than about 150 nm (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about 1 ¼, particles or surface roughness features per square millimeter." The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

In regards to claims 2 and 9, Applicant's Prior Art discloses the following:

a) the anti-reflective material comprises silicon atoms and nitrogen atoms (For Example: See Paragraph 36).

Art Unit: 2822

In regards to claims 3 and 10, Applicant's Prior Art discloses the following:

a) the anti-reflective material further comprises oxygen atoms (For Example: See Paragraph 36).

In regards to claims 4 and 11, Applicant's Prior Art fails to disclose the following:

a) the anti-reflective material comprises $\text{Si}_x\text{O}_y\text{N}_z$ where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z.

However, the applicant has not established the critical nature of "the anti-reflective material comprises $\text{Si}_x\text{O}_y\text{N}_z$ where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

In regards to claims 5 and 12, Applicant's Prior Art discloses the following:

a) a surface of said the first layer is substantially free of at least one of measurable particulates and surface roughness (For Example: See Figure 4).

In regards to claim 6, Applicant's Prior Art discloses the following:

a) the second layer is substantially free of at least one of particles and surface roughness features of at least about 120 nm (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about 1 1/4, particles or surface roughness features per

Art Unit: 2822

square millimeter.” The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

In regards to claims 7 and 14, Applicant's Prior Art discloses the following:

a) the second layer is formed on the first layer (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art discloses the following:

a) a first layer comprising anti-reflective material (For Example: See Figure 4);

b) a second layer comprising silicon nitride, located over the first layer, and including in-film particles (For Example: See Figure 4); and

c) substantially free of particles or surface roughness features of at least 120 nanometers (For Example: See Paragraph 9 and 36) (Note: Although the specification does not specifically disclose the limitation above, Applicant disclosed in the response that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about 1 ¼, particles or surface roughness features per square millimeter." The prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight-inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In re Woodruff, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges

Art Unit: 2822

overlapped.); In re Geisler, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. Titanium Metals Corp. of America v. Banner, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985)).

6. Claims 1-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Applicant's Prior Art in view of *Performance of a Vertical LPCVD Apparatus* by Ogawa et al.

In regards to claim 1, Applicant's Prior Art discloses the following:

a) a first layer (42) comprising anti-reflective material (For Example: See Figure 4); and

b) a second layer (46) comprising silicon nitride, located over the first layer, and including in-film particles (44) (For Example: See Figure 4).

In regards to claim 1, Applicant's Prior Art fails to disclose the following:

a) substantially free of in-film particles or surface roughness features of more than about 150 nm.

However, Ogawa et al. ("Ogawa") discloses a layer that is substantially free of in-film particles or surface roughness of more than 150 nm (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of in-film particles or surface roughness of more than 150 nm as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Art Unit: 2822

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

In regards to claims 2 and 9, Applicant's Prior Art discloses the following:

a) the anti-reflective material comprises silicon atoms and nitrogen atoms
(For Example: See Paragraph 36).

In regards to claims 3 and 10, Applicant's Prior Art discloses the following:

a) the anti-reflective material further comprises oxygen atoms (For Example: See Paragraph 36).

In regards to claims 4 and 11, Applicant's Prior Art fails to disclose the following:

a) the anti-reflective material comprises $\text{Si}_x\text{O}_y\text{N}_z$ where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z.

However, the applicant has not established the critical nature of "the anti-reflective material comprises $\text{Si}_x\text{O}_y\text{N}_z$ where x equals about 0.40 to about 0.65 times the sum of x, y, and z, y equals about 0.02 to about 0.56 times the sum of x, y, and z, and z equals about 0.05 to about 0.33 times the sum of x, y, and z." "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir.1990). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have various ranges.

Art Unit: 2822

In regards to claims 5 and 12, Applicant's Prior Art discloses the following:

a) a surface of said the first layer is substantially free of at least one of measurable particulates and surface roughness (For Example: See Figure 4).

In regards to claim 6, Applicant's Prior Art fails to disclose the following:

a) the second layer is substantially free of at least one of particles and surface roughness features of at least about 120 nm.

However, Ogawa discloses a layer that is substantially free of at least one of particles and surface roughness features of at least about 120 nm (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of at least one of particles and surface roughness features of at least about 120 nm as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

In regards to claims 7 and 14, Applicant's Prior Art discloses the following:

a) the second layer is formed on the first layer (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art discloses the following:

a) a first layer comprising anti-reflective material (For Example: See Figure 4); and

b) a second layer comprising silicon nitride, located over the first layer, and including in-film particles (For Example: See Figure 4).

In regards to claim 8, Applicant's Prior Art fails to disclose the following:

a) substantially free of in-film particles or surface roughness features of at least about 120 nanometers.

However, Ogawa discloses a layer that is substantially free of in-film particles or surface roughness features of at least about 120 nanometers (For Example: See Abstract). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Applicant's Prior Art to include a layer that is substantially free of in-film particles or surface roughness features of at least about 120 nanometers as disclosed in Ogawa because it aids in reducing particle defects (For Example: See Page 1103).

Additionally, since Applicant's Prior Art and Ogawa are both from the same field of endeavor, the purpose disclosed by Ogawa would have been recognized in the pertinent art of Applicant's Prior Art.

Response to Arguments

7. Applicant's arguments filed 9/6/07 have been fully considered but they are not persuasive. First, Applicant argued that "the scope and meaning of the phrase substantially free of in-film particles or surface roughness features i.e., that the number of in-film particles or surface roughness features is substantially reduced below about 40,000 or more per eight inch diameter wafer...the BACKGROUND section does not teach or suggest that the surface of a layer that comprises anti-reflective material may be substantially free of at least one of measurable particulates or surface roughness." Applicant disclosed in the response (12/16/04) that "semiconductor devices that have an imperfection density of less than about 40,000 particles of about 120-150 nm dimension per eight inch diameter...result is a maximum imperfection density of 1.27, or about $1 \frac{1}{4}$, particles or surface roughness features per square millimeter." The

prior art discloses that in-film particles have a size of about 120-150 nm and a density on the semiconductor device structure 40 of about 40,000 or more per eight inch diameter wafer. In the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art" a prima facie case of obviousness exists. In *re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976); In *re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990) (The prior art taught carbon monoxide concentrations of "about 1-5%" while the claim was limited to "more than 5%." The court held that "about 1-5%" allowed for concentrations slightly above 5% thus the ranges overlapped.); In *re Geisler*, 116 F.3d 1465, 1469-71, 43 USPQ2d 1362, 1365-66 (Fed. Cir. 1997) (Claim reciting thickness of a protective layer as falling within a range of "50 to 100 Angstroms" considered prima facie obvious in view of prior art reference teaching that "for suitable protection, the thickness of the protective layer should be not less than about 10 nm i.e., 100 Angstroms." The court stated that "by stating that suitable protection' is provided if the protective layer is about' 100 Angstroms thick, the prior art reference directly teaches the use of a thickness within applicant's claimed range."). Similarly, a prima facie case of obviousness exists where the claimed ranges and prior art ranges do not overlap but are close enough that one skilled in the art would have expected them to have the same properties. *Titanium Metals Corp. of America v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985).

Second, Applicant argued that the "Ogawa teaches processes by which dust particle contamination may be reduced, the disclosure of Ogawa is limited to quantification of dust particles having diameters of larger than 0.2 um or larger than 200 nm...Ogawa includes no teaching or suggestion that a semiconductor device structure may include a layer that comprises silicon nitride and that is substantially free of in-film particles or surface roughness features of at

Art Unit: 2822

least 120 nm...or of more than 150 nm.” However, Ogawa discloses that “the number of particles per square centimeter for particles larger than .2 μm was less than ca. 1/6 of that obtained using a conventional horizontal LPCVD apparatus, when Si_3N_4 was deposited” (For Example: See Abstract). Therefore, Ogawa does disclose a semiconductor device structure may include a layer that comprises silicon nitride and that is substantially free of in-film particles or surface roughness features of at least 120 nm...or of more than 150 nm.

Finally, Applicant argues that prior art does not teach or suggest that the surface of a layer that comprises anti-reflective material may be substantially free of at least one of measurable particulates or surface roughness...Fig. 4 of the above referenced application shows a large number of in-film particles 44 on the surface of dielectric anti-reflective coating (“DARC” film 42)...the above referenced application explains that the presence of about 40,000 or more non-uniformities or particles in a silicon nitride layer.” Merriam-Webster defines “substantially” as being largely but not wholly that which is specified. Although the prior art discloses in-film particles (44) on film 42, it appears from figure 4 that the first layer is “substantially” free of at least one of measurable particulates or surface roughness.”

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

Art Unit: 2822

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 571-272-1838. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300 for regular and after final communications.

ML
November 8, 2007



MONICA LEWIS
PRIMARY PATENT EXAMINER